



## PURA syndrome

*PURA* syndrome is a condition characterized by intellectual disability and delayed development of speech and motor skills, such as walking. Expressive language skills (vocabulary and the production of speech) are generally more severely affected than receptive language skills (the ability to understand speech), and most affected individuals are unable to speak. People with *PURA* syndrome may learn to walk later than their peers; many are never able to walk. In infancy, affected infants have very weak muscle tone (hypotonia) and feeding difficulties. Problems with swallowing (dysphagia) can last throughout life. In addition, affected infants can be excessively sleepy (hypersomnolent), have a low body temperature (hypothermia), and have short pauses in breathing (apnea) or episodes of abnormally slow breathing (hypoventilation). These breathing problems usually go away after age 1.

Recurrent seizures (epilepsy) are also common in *PURA* syndrome. Seizures usually begin before age 5 with uncontrolled muscle jerks (myoclonus). Other types of seizures can develop, such as generalized tonic-clonic seizures, which involve loss of consciousness, muscle rigidity, and convulsions. In people with *PURA* syndrome, seizures are often difficult to control.

Other features in people with *PURA* syndrome can include abnormalities of the heart, eyes, urogenital tract, gastrointestinal tract, and skeleton. Some affected individuals have symptoms of a hormonal problem, such as early sexual development (precocious puberty) or low levels of vitamin D (which is a hormone).

### Frequency

*PURA* syndrome is a rare condition affecting at least 70 individuals. It is estimated to account for fewer than 1 percent of cases of developmental delay.

### Causes

*PURA* syndrome is caused by mutations in the *PURA* gene, which provides instructions for making a protein called Pur-alpha ( $\text{Pur}\alpha$ ). This protein has multiple roles in cells, including controlling the activity of genes (gene transcription) and aiding in the copying (replication) of DNA. The  $\text{Pur}\alpha$  protein is especially important for normal brain development.  $\text{Pur}\alpha$  helps direct the growth and division of nerve cells (neurons). It may also be involved in the formation or maturation of myelin, the protective substance that covers nerves and promotes the efficient transmission of nerve impulses.

Mutations in the *PURA* gene are thought to lead to a reduced amount of functional  $\text{Pur}\alpha$  protein. Although it is not understood how a partial loss of  $\text{Pur}\alpha$  function leads to the signs and symptoms of *PURA* syndrome, researchers suspect that it may alter

normal brain development and impair the function of neurons, leading to developmental problems and seizures in people with the condition.

## **Inheritance Pattern**

This condition is inherited in an autosomal dominant pattern, which means one copy of the altered gene in each cell is sufficient to cause the disorder.

Most cases of this condition result from new (de novo) mutations in the gene that occur during the formation of reproductive cells (eggs or sperm) in an affected individual's parent or in early embryonic development. These cases occur in people with no history of the disorder in their family.

## **Other Names for This Condition**

- PURA-related neurodevelopmental disorder
- PURA-related severe neonatal hypotonia-seizures-encephalopathy syndrome

## **Diagnosis & Management**

### Genetic Testing Information

- What is genetic testing?  
[/primer/testing/genetictesting](#)
- Genetic Testing Registry: Mental retardation, autosomal dominant 31  
<https://www.ncbi.nlm.nih.gov/gtr/conditions/C4015357/>

### Other Diagnosis and Management Resources

- GeneReview: PURA-Related Neurodevelopmental Disorders  
<https://www.ncbi.nlm.nih.gov/books/NBK426063>

## **Additional Information & Resources**

### Health Information from MedlinePlus

- Encyclopedia: Hypotonia  
<https://medlineplus.gov/ency/article/003298.htm>
- Encyclopedia: Intellectual Disability  
<https://medlineplus.gov/ency/article/001523.htm>
- Health Topic: Developmental Disabilities  
<https://medlineplus.gov/developmentaldisabilities.html>
- Health Topic: Speech and Communication Disorders  
<https://medlineplus.gov/speechandcommunicationdisorders.html>

### Genetic and Rare Diseases Information Center

- PURA syndrome  
<https://rarediseases.info.nih.gov/diseases/12836/pura-syndrome>

### Additional NIH Resources

- Eunice Kennedy Shriver National Institute of Child Health and Human Development: Intellectual and Developmental Disabilities  
<https://www.nichd.nih.gov/health/topics/idds>
- National Institute of Neurologic Disorders and Stroke: Epilepsy Information Page  
<https://www.ninds.nih.gov/Disorders/All-Disorders/Epilepsy-Information-Page>
- National Institute of Neurologic Disorders and Stroke: Hypotonia Information Page  
<https://www.ninds.nih.gov/Disorders/All-Disorders/Hypotonia-Information-Page>
- National Institute on Deafness and other Communication Disorders: Speech and Language Developmental Milestones  
<https://www.nidcd.nih.gov/health/speech-and-language>

### Educational Resources

- Centers for Disease Control and Prevention: Epilepsy  
<https://www.cdc.gov/epilepsy/index.html>
- Centers for Disease Control and Prevention: Facts About Intellectual Disability  
[https://www.cdc.gov/ncbddd/actearly/pdf/parents\\_pdfs/IntellectualDisability.pdf](https://www.cdc.gov/ncbddd/actearly/pdf/parents_pdfs/IntellectualDisability.pdf)
- KidsHealth from Nemours: Delayed Speech or Language Development  
<https://kidshealth.org/en/parents/not-talk.html>
- MalaCards: pura syndrome  
[https://www.malacards.org/card/pura\\_syndrome](https://www.malacards.org/card/pura_syndrome)
- Merck Manual Consumer Version: Seizure Disorders  
<https://www.merckmanuals.com/home/brain,-spinal-cord,-and-nerve-disorders/seizure-disorders/seizure-disorders>
- Orphanet: PURA-related severe neonatal hypotonia-seizures-encephalopathy syndrome  
[https://www.orpha.net/consor/cgi-bin/OC\\_Exp.php?Lng=EN&Expert=438213](https://www.orpha.net/consor/cgi-bin/OC_Exp.php?Lng=EN&Expert=438213)
- Unique: Rare Chromosome Disorder Support Group (UK)  
<https://www.rarechromo.org/media/singlegeneinfo/Single%20Gene%20Disorder%20Guides/PURA%20and%205q31%20FTNW.pdf>

### Patient Support and Advocacy Resources

- American Association on Intellectual and Developmental Disabilities  
<https://www.aaidd.org/>
- American Epilepsy Society  
<https://www.aesnet.org/>
- American Speech Language Hearing Association  
<https://www.asha.org/>
- PURA Syndrome Foundation  
<https://www.purasyndrome.org/>
- Resource List from the University of Kansas Medical Center: Developmental Delay  
<http://www.kumc.edu/gec/support/devdelay.html>

### Clinical Information from GeneReviews

- PURA-Related Neurodevelopmental Disorders  
<https://www.ncbi.nlm.nih.gov/books/NBK426063>

### Scientific Articles on PubMed

- PubMed  
<https://www.ncbi.nlm.nih.gov/pubmed?term=%28PURA+syndrome%5BTIAB%5D%29+OR+%28%28PURA%5BTIAB%5D%29+AND+%28developmental+delay%5BTIAB%5D%29%29+OR+%28%28PURA%5BTIAB%5D%29+AND+%28hypotonia%5BTIAB%5D%29%29+OR+%28%28PURA%5BTIAB%5D%29+AND+%28neurodevelopmental%5BTIAB%5D%29%29+AND+english%5Bla%5D+AND+%22last+3600+days%22%5Bdp%5D>

### Catalog of Genes and Diseases from OMIM

- MENTAL RETARDATION, AUTOSOMAL DOMINANT 31  
<http://omim.org/entry/616158>

### Medical Genetics Database from MedGen

- Mental retardation, autosomal dominant 31  
<https://www.ncbi.nlm.nih.gov/medgen/863794>

## Sources for This Summary

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